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ABSTRACT

Project C-BE had four goals: identify computer-based concepts that are common among several disciplines, develop evaluation procedures for this type of effort, identify the elements of educational program transferability, and develop a fiscal model. This document lists Project C-BE researchers and gives a brief abstract of their project committees, lists project equipment and publications. (JY)

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GOALS OF THE PROJECT

Listed below are the four (4) objectives of our research as NSF views the effort.

I. IDENTIFY COMPUTER-BASED CONCEPTS THAT ARE COMMON AMONG SEVERAL DISCIPLINES

With reference to reactive terminals, computer graphics, or laboratory data acquisition--identify what concepts are common among several disciplines in either content, approach or technique.

II. DEVELOP EVALUATION PROCEDURES FOR THIS TYPE EFFORT

Develop procedures for evaluating the pedagogical and economic effectiveness and potential of computer-based techniques at the module, course, university, and national levels.

III. IDENTIFY THE ELEMENTS OF TRANSFERABILITY

Identify the elements of the effort that are critical to transferring successful educational packages, employing these techniques, from one institution to another.

IV. DEVELOP A FISCAL MODEL

Develop a fiscal model so that administrators may view these techniques from the standpoints of investment, operating expenses, comparative effectiveness.

Becker, E. B.

"Interactive Graphics for Instruction in Structural Synthesis"

Aerospace Engineering Department

ENS 333

Dr. Becker proposes to incorporate interactive graphic systems in the training of aerospace engineers. This will include a review of the current use of interactive graphics in teaching and in structual analysis and design in other academic and in industrial locations; evaluation of courses and their effect on students' performance. It is felt that the students' range of experience with structural behavior can be broadened tremendously through the use of an interactive graphics system. The analysis and design of structural members and systems is the general problem area to which the interactive system will be first applied.

Bruell, J. H.

Psychology Department

"Computer Tools for Classroom and Selfpaced Instruction"
MEZ 313

A system of tools for the evaluation and guidance of students will be developed. The tools will be general enough to be useful in most academic disciplines, simple enough to be used by persons without computer experience, and they will be applicable in traditional classroom situations and in interactive self-paced instruction. Major elements of the system will be (2) a computer-based system for class record keeping; (b) a system of computer aids for the construction, administration, analysis and grading of computer-scorable tests; and (c) a computer-based instructional guidance system.

While the three systems will be carefully integrated, it will be possible to use any one of them independently of the others. Subsystems will be operational throughout the project period but new improved versions of each system will be installed as work on them progresses.

Castleberry, S. J.

Chemistry Department

"The General Chemistry Project"

ESB 520

The chemistry project is divided into two general areas: (1) computer-based instructional methods as applied to laboratory work, and (2) the use of computer-based instructional methods in theoretical chemistry designed for first-year students.

We feel that computer simulation of laboratory experiments has distinct advantages over other methods used before, e.g., giving the students prototype handouts with data for analysis. Computer techniques can be developed that (1) elicit the active participation of each student, (2) drive the student to make the same experimental design decisions he would have to make in the laboratory, (3) provide for the generation of unique data and constraints for each student, (4) provide immediate and positive reinforcement of desired behavior, (5) provide the immediate correction for undesired behavior, (6) provide for the diagnosis of the absence of necessary pre-skills, and (7) provide tutorial material to help the student acquire necessary pre-skills.

This portion of the chemistry project will be primarily concerned with developing a laboratory course at the introductory level which will include real laboratory experiments integrated with computer simulated experiments, student use of the computer for monitoring real experiments and for data analysis, computer managed evaluation of student progress and the opportunity for the use of computer-based tutorial and/or remedial programs.

Durrett, Mary Ellen

Home Economics Department

"Child Development Computer-Based Education"

HEB 115

The purpose of this project is to develop an inter-active computer-based educational program for a beginning course in child development which would serve as a supplement to the instructor. The goals of such a course are to help the student: gain insight into the sensory, physical and motor, verbal, mental, emotional and social development of the child; recognize and appreciate the uniqueness of each child; and to become familiar with research in the area.

The benefits of a computer program are two-fold. It would be possible to provide continuing guidance to students on factors to be observed and also immediate feedback on accuracy of perceptions and insights thus the learning of observational skills should be acquired more rapidly. Secondly, the system can be used to keep very accurate records of student performance which allows analysis in some depth. A further advantage is that this system would provide a very convenient vehicle for the gathering of data for research projects on the behavior of children. The observer's responses to the children can be recorded in the computer system directly in forms convenient for further analysis.

Fowler, W. T. & D. G. Hull

Aerospace Engineering Department

"Preliminary Design of Aircraft"

TAY 227

The process of preliminary design of a complex system such as an aircraft is not well taught in the present aerospace engineering curriculum due to the amount of analysis and computation necessary to carry out the evaluation of even a single design iterate in the actual design process. It is proposed that a computer-based aircraft design augmentation system (an interactive system for aircraft performance, stability, and control computation) be written which would allow the student to evaluate the performance parameters and stability and control characteristics of a specific aircraft design in a short time. The student would spend his time in actually carrying out design decisions rather than in laboriously calculating the many interrelated quantities upon which design decisions are based.

The computer-based design augmentation system will be written as a set of self-contained, compatible modules which (1) can be used separately to compute specific performance or stability parameters, or (2) can be used in conjunction with a driving program to carry out a complete performance, stability, and control design iteration (or any desired part thereof).

The objectives of the proposal are to develop a system of tools for the enhancement of the student's design experience in the aircraft design course. The tools will be general enough to be used in aerospace engineering curricula throughout the nation and in all those mechanical engineering curricula having aerospace options. In addition, the driver program will be written in such a manner that it will be capable of evaluating the performance of complex systems other than aircraft.

Fox, J. Lawrence

Zoology Department

"Biophysical Analysis"

PAT 324

Biophysical Analysis is a lecture oriented course describing the theory, instrumentation and interpretation for collecting physical data from biological materials. The purpose of this proposal is to develop a new course which serves several objectives:

1. To furnish the advanced student with subject matter structured around a real laboratory environment which would allow in-depth learning of physical-chemical techniques. This will be accomplished by computer simulation.

2. To acquaint the student with the theory and methodology used in data collection and data analysis in typical research experiments. Traditional examples will be programmed into analog/digital computer system inputs. Statistical analysis of data collected during laboratory experiments is planned through use of on-line terminal devices. Thus, typical experiments and those too difficult to conduct in a limited resource laboratory may be presented.

3. To provide the student with a library resource of readily available programs which may be locally controlled by student inputs to the computer as a means of reviewing on a step-by-step basis various stages of an experiment.

4. To examine the feasibility of computer-based instruction with advanced students.

5. The reduction of class time devoted to specific subjects amenable to computer instruction will allow an expansion of material subjects covered.

Gavenda, J. D.

Physics Department

"Computer-Based Undergraduate Physics Instruction"

PHY 428

This project is for the development of an introductory physics course for beginning science majors using computer based instruction techniques in a laboratory environment for illustrating and studying the particle nature of matter. Teletypewriter terminals and digital plotters for graphic output will be used by the student. Large screen display of graphics during lectures will be accomplished using CRT terminals which can generate a video signal, and conventional television monitors. A mini-computer with analog-to-digital converters will be used to collect data in the laboratory.

Himmelblau, D. M. "On-Line Process Simulation"

Chemical Engineering Department EPS 211A

Classroom simulation of continuous processes by representative process models can be used by the instructor to visually portray dynamic process responses. With appropriate visual display hardware, the student receives information in a much more realistic form than through the use of static visual aids or from a textbook. Both the instructor and the student can execute parametric sensitivity studies, carry out economic evaluations, and illustrate process control in real time.

The general objective of this proposal is to prepare the necessary interactive mode software compatible with a suitable remote visual display terminal for classroom instruction and student homework in process analysis and simulation. Fortran level software to accommodate several process models will be prepared for and texted in Ch.E. 376 (Process Analysis and Simulation), a course previously taught by the lecture methods with standard visual aids.

Hoberock, L. L.

Mechanical Engineering Department

"Automatic Control and Dynamic Systems Instruction Using Hybrid Computation"

TAY 418

The objectives of the proposed program are:

1. To design a carefully integrated set of "lecture" and "terminal" instructional units for more effective student learning in simulation and control of dynamic systems.
2. To provide students with "hands-on" analysis and control of carefully selected simulated systems.
3. To provide simulated design problems in control with fast computation and simulation capability.
4. To provide hardware and simulated hardware controllers for real-world modelling and control.

These objectives will be achieved through two primary thrusts, (1) integrating the lecture and laboratory material by means of a new, proven system of self-paced system of instruction called PSI, (2) designing "terminal" instructional units, integrated with "lecture" units, to be used with a larger number of time-shared hybrid terminals. Computer-based instruction in this discipline is necessary because dynamic system behavior and control is sufficiently complex that textbook presentations, hand calculations, and all-laboratory hardware are insufficient for modern problems.

Matsen, F. A. "Computers in Lectures (CIL)"

Chemistry Department CHE 202W

The material involves students in a sophisticated mathematical environment, and it is desirable to investigate the apparently great usefulness of the computer in teaching such material to a large number of students in one lecture hall. The computer's principal assets in aiding a classroom lecture are (1) the increased amount of material that can be displayed efficiently for demonstration of theoretical calculations and their applications to specific problems; (2) the superior methods of display possessed by remote computer facilities; (3) interactive capabilities, allowing students to practice solving problems in the classroom using the computational power of the computer, with special consideration of the value of all student's being able to learn from each mistake made in the classroom demonstration under the supervision of the instructor; (4) transferability of the demonstration, especially important at large universities where space is often in doubt, and locations are often varied.

The general objective of the proposed utilization of remote computer facilities are:

1. Develop a classroom technique including the use of the computer facilities;

2. Utilize as many programs as are currently available for classroom demonstration, to judge their effectiveness;

3. Investigate the range of capabilities of the computer as a lecture adjunct by experimenting with various forms of demonstration and student interaction at certain points during the lecture; and

4. Develop transferability of the computer aid by using equipment easily transportable, by recording the terminal displays for use in other classrooms where "live" demonstrations are not possible.

Rodewald, L. B.
& J. C. Gilbert

Chemistry Department

"The Application of Computers to Organic Chemistry Instruction"

CHE 336

The primary concern of this project will be the development testing, and evaluation of a second semester undergraduate organic chemistry course that will incorporate a large scale application of these aspects including real and computer-simulated experimentation; student use of the computer for the manipulation of experimental data; computer-managed evaluation of student progress; and provisions for computer assisted instruction in organic theory and fundamentals, including nomenclature, reactions, reaction mechanisms, synthesis, and spectroscopic interpretations. Other prime objectives within the project are:

1. To describe the requirements necessary for successful transportability and execution of computer programs from one system and language to another system and language; and,

2. To evaluate the common computer language BASIC as a medium to design computer-based instructional materials in organic chemistry. It is anticipated that this portion of the project will involve two modules which have been previously developed in CLIC.

Smith, Don W.

Biological Sciences Department

"Computer-Based Learning System for Introductory Statistics"
North Texas State University

Dr. Smith will assist Dr. G. R. Wagner in revision of an introductory statistics course that is composed of modules and sub-modules for self-paced instruction and adapt it for use on an IBM 360 at North Texas State University. In addition, Dr. Smith will assemble the three existing systems (one at NTSU, one at The University of Texas, and one available from IBM) for giving and evaluating exams into a single one that can generate and score exams, tabulate and continuously update data on quality and difficulty of each question and maintain a "grade book" for a basic Botany course.

Wagner, G. R.

Mechanical Engineering Department

"Computer-Based Learning System for Applied Statistics"
ENL 201

Course work in statistics can be interesting and challenging, but usually is not.

1. The use of computers can be to generate data from student-designed experiments and the data subsequently analyzed by a routine selected by the student.

2. A more valuable use of computers in teaching statistics is for empirically verifying theory.

3. Most challenging use of computers is the design of pedagogy which results in students discovering theory and methods as a result of need, i.e., given raw data, human judgment, rapid and easy computational power and tutorial hints let students seek a probabilistic method of deriving information from data.

The overall goal is to use computers to provide students with extensive empirical experience to support learning.

White, J. M.

Chemistry Department

"Computer-Based Instruction in Physical Chemistry"
CHE 119B

Th proposal by J. M. White is based on four major objectives:

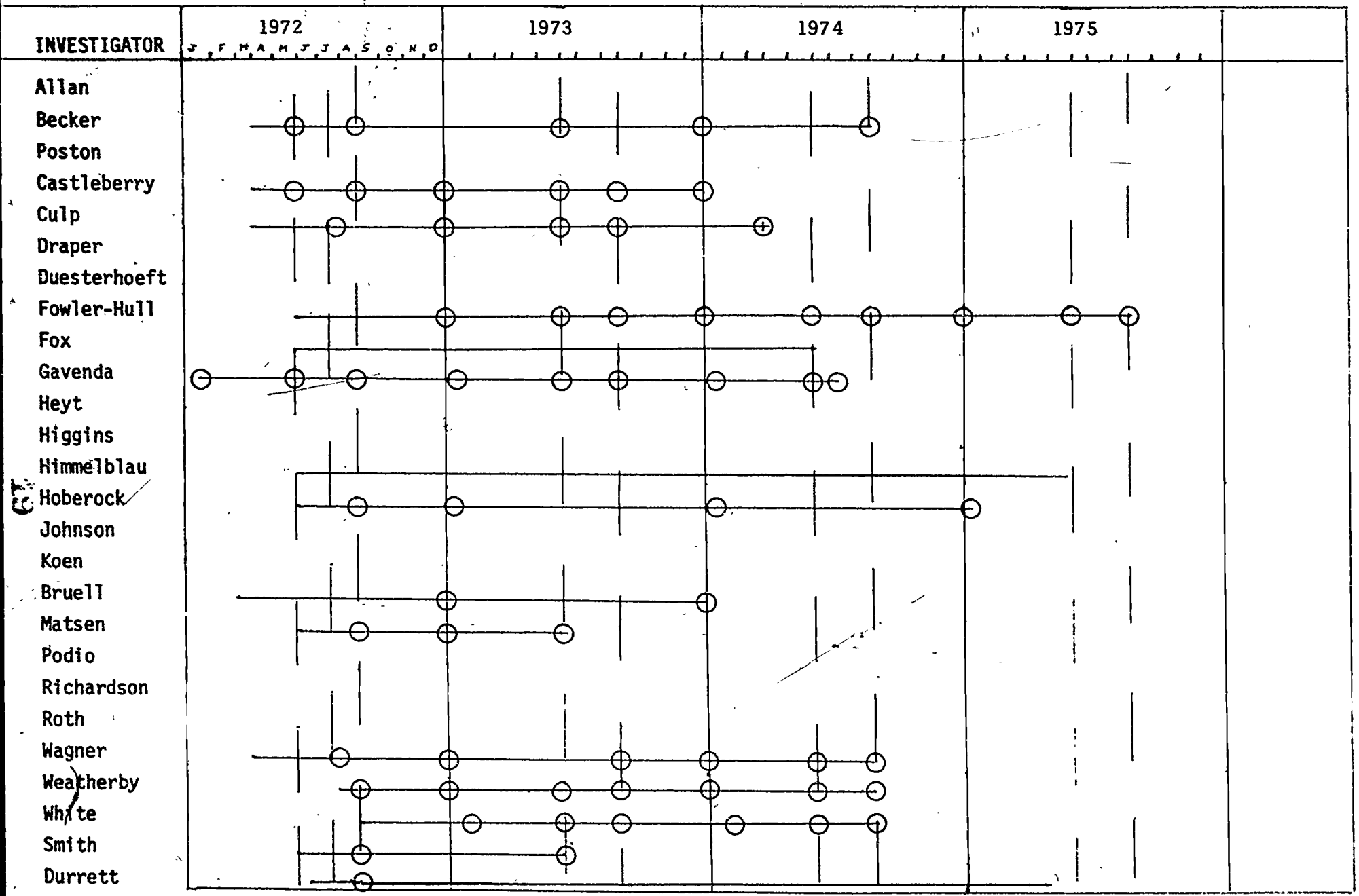
1. Remedial Modules - to develop modules employing computer-based interactive programming which will provide the student with properly reinforced study of how to find, use and interpret partial derivatives.

2. Computer Simulated Extension of Lab Experiments - to develop modules which use the computer to generate data for experiments partially completed in the laboratory.

3. Simulated Experiments - to develop modules which generate data corresponding to important experiments.

4. Theoretical Chemistry and Numerical Analysis - to develop modules which students can use to investigate examples of theoretical problems.

ASSOCIATE INVESTIGATOR PHASING CHART



COMMITTEE MISSIONS

The following are the initial missions of the designated committees. In addition to the following, every committee has the additional charge of recommending modifications to the scope and method of operation of that particular committee.

PROJECT SELECTION AND REVIEW COMMITTEE

This committee will select projects to be funded according to an outline furnished by the Project Office. Also, investigator progress will be reviewed as to content and time schedule compliance. Based on past, current, and scheduled status, action will be recommended for the Project Co-Directors to take.

IMPLEMENTATION MODEL COMMITTEE

This committee will define the model of this project that will enable interested parties to ask significant questions and get answers about projecting our operation to another environment. Also they will help us identify what must be monitored now so that we can generate meaningful observations later -- and a workable methodology for achieving this goal.

TRANSFERABILITY COMMITTEE

This committee should define what transferability of educational materials should mean. Further, they should develop a way that we can warp our modus operandi to color our plans, ideas and assumptions toward transferability, and an idea of potential national implications.

EVALUATION PROCEDURES COMMITTEE

This committee should develop criteria for project selection and review recognizing that there are two types of criteria (a) Legislative and, (b) Judicial. They should also evolve procedures applicable to evaluating:

a. individual modules
b. courses
c. the impact on University
d. national impact

PUBLICATIONS COMMITTEE

This committee should define how we can make the biggest impact with this project as our associate investigators publish in refereed journals. viz: where to publish, coordination of our papers, references to other work, and new perspectives to take from our results.

This is not a "publication review" committee, but a group to be consulted to help insure a consolidated technical and popular P.R. effort.

EDUCATIONAL POLICY MATTERS COMMITTEE

This committee is to serve as a reference for our work with the Deans, Department Chiarmen and Advisory Panel so that our progress does not unnecessarily perturbate the system, but so that our results can be used to the maximum advantage of our beneficiaries.

ROYALITY RIGHTS COMMITTEE

This committee is to consider the question of royalty rights, and suggest action.

HARDWARE RELIABILITY

Project C-BE has coordinated a repair and maintenance service for the University of Texas campus as well as for its own hardware. As of September 15, 1972, a total of 61 teletypewriters are signed up under maintenance contracts, which are being coordinated and handled through Project C-BE. The personnel and supply costs are on a self-paying basis, and were used to determine the cost of a subscription to the service. The current rate structure is a $30 one time charge and $19 per month per teletype. All parts and labor are then provided except replacement of motors and intentional or careless physical damage.

Emergency trouble calls which averaged 3 or more a day at the start of service on June 15, 1972 have reduced to about one a day because of an intensive scheduled maintenance program. In addition, a new model ASR-33 teletype has been acquired as the "back up" spare in case a direct replacement is needed for major failures.

The following is a brief list of equipment being used on Project C-BE:

QUANTITY	DESCRIPTION OF EQUIPMENT	DEPARTMENTS INVOLVED
15	Model KSR-33 Teletypewriters	Physics, Psychology, Mechanical Engineering, Chemical Engineering, Aerospace Engineering, Home Economics, Chemistry, Zoology, Economics, Civil Engr.
2	CC-30 CRT Terminals	Chemistry
6	Datapoint Terminal Model 3300	Computer Graphics Facility (all projects)
4	IMLAC Graphics Terminal, 21" screen	Computer Graphics Facility (all projects)
1	Beehive CRT Terminal	Chemistry
4	Model ASR-33 Teletypewriters	Chemistry
1	Texas Instruments, Model 725 Teleprinter	Chemistry
9	Omnitec Model 701A	Computer Graphics Facility (all projects)
4	Acoustic Coupler A-J Model 260	Chemistry
1	Model TSP-212 Plotter	Physics
1	Real Time Computer System (16K NOVA 820)	Computer Graphics Facility (all projects)
2	Computer-Based Data Acquisition System (8K NOVA 820)	Engineering Chemistry
3	Analog/Hybrid Terminals	Mechanical Engineering
1	Decision Model 650 Optical Scanner	Psychology

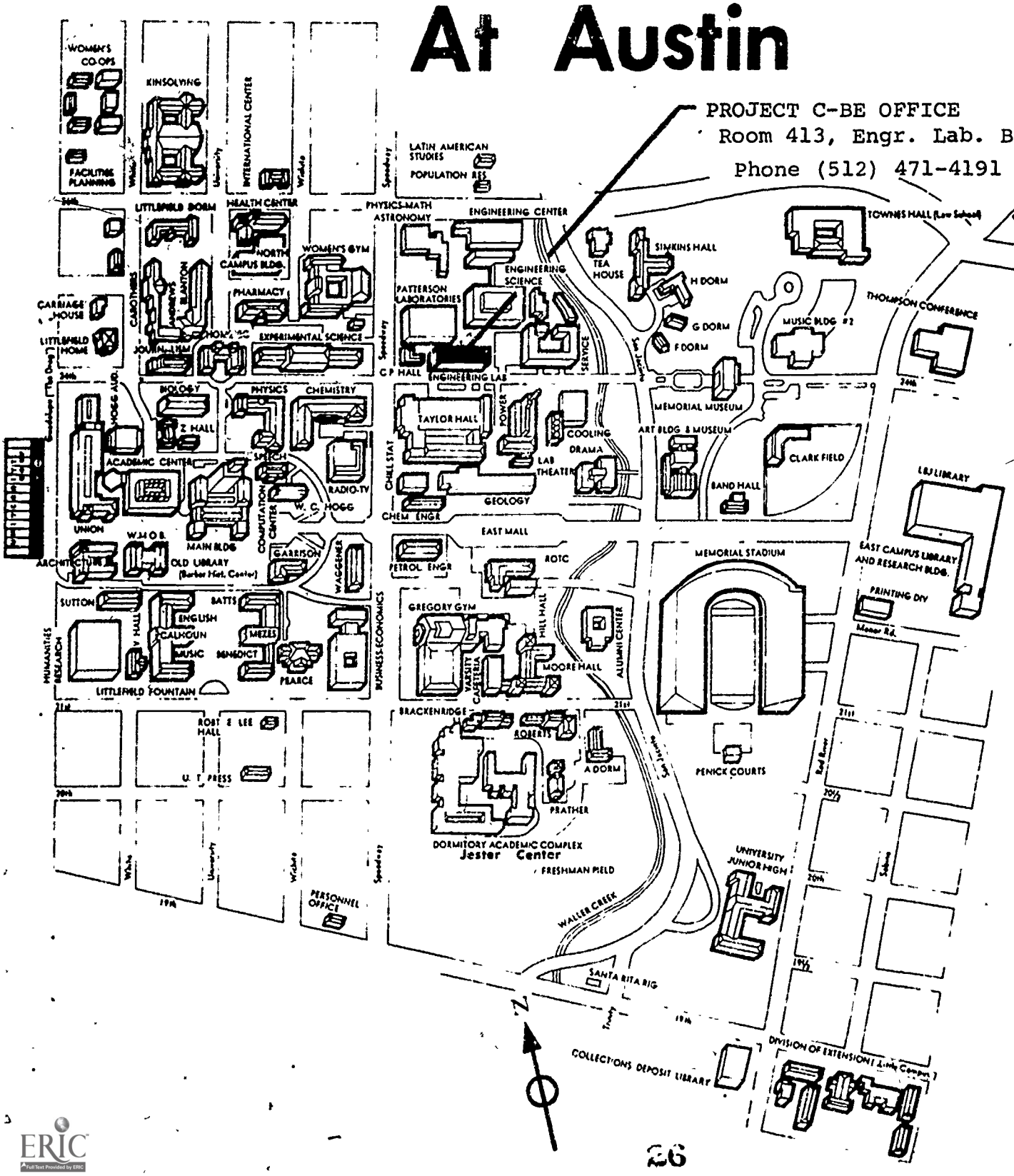
PROJECT C-BE IN ACTION

Alphanumeric Terminals in The New Graphics Facility.

One of Five Terminals in the Experimental Science Cluster.

A Psychology Class
in Introductory Statistics
operating Datapoint 3300 CRT's

The University Of Texas At Austin



REFERENCES

PROJECT C-BE ADMINISTRATIVE PUBLICATIONS

A-1	Goals of the Project	(PMOM-2/1/7/72)
A-2	Project Personnel	(PMOM-3/1/7/72)
A-3	Organization Charts	(PMOM-4/1/7/72)
A-4	Management Responsibility	(PMOM-5/1/7/72)
A-5	Publication Index	(PMOM-1/1/5/72)
A-6	Budget	(PMOM-6/1/7/72)
A-7	Committees	(PMOM-9/1/17/72)
A-8	Project Time Phasing Chart	(PMOM-7/1/7/72)
A-9	Investigator Continuing Status Charts	(PMOM-12/1/17/72)
		(PMOM-11/1/17/72)
A-10	Initiation of Projects	(PMOM-20/1/18/72)
A-11	Purchasing Procedures	(OM-1/1/5/72)
A-12	Requisition Form	(OM-3/1/5/72)
A-13	Hardware Repair Procedures	(PMOM-13/1/17/72)
A-14	Hardware Repair Forms (2)	(PMOM-14/1/17/72)
		(PMOM-15/1/17/72)
A-15	Personnel Procedures	(PMOM-16/1/17/72)
A-16	Fiscal Control	(PMOM-17/1/17/72)
A-17	Budget Control System	(PMOM-19/1/18/72)
A-18	Title to Equipment	(PMOM-18/1/17/72)
A-19	Map for Project Logistics	(PMOM-10/1/17/72)
A-20	Format for Preparing Research Proposals	(PMOM-20/1/18/72)
A-21	January 1972 Newsletter	(CBEN-1/1/17/72)
A-22	February 1972 Newsletter	(CBEN-2/2/25/72)
A-23	March 1972 Newsletter	(CBEN-3/3/28/72)
A-24	April 1972 Newsletter	(CBEN-4/4/28/72)

A-25	General Information on Project C-BE	(EP-1/2/24/72)
A-26	Initial Ideas for Implementation Model Comm.	(IP-1/3/24/72)
A-27	Publications by Associate Investigators	(PMOM-22/5/2/72)
A-28	May 1972 Newsletter	(CBEN-5/5/30/72)
A-29	June-July 1972 Newsletter	(CBEN-7/25/72)
A-30	Rates of Pay for Students in Research	(OM-6/4/12/72)
A-31	Maintenance Schedule on Terminal Devices	(PMOM-23/6/16/72)
A-32	Evaluation Procedures Comm. Progress Report	(IP-2/6/7/72)

PROJECT C-BE INVESTIGATOR PUBLICATIONS

I-1 Wagner, G. R., Neale, J. W. and McCants, M. M. "A Computer Quizzing System Adaptive to Individual Student Behavior," April 1972.

I-2 Wagner, G. R., McCants, M. M., and Neale, J. W. "An Interactive Computer Quizzing System to Support the Proctorial System of Instruction."